

Degree	Type	Year
High Energy Physics, Astrophysics and Cosmology	OT	0

Contact

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Teachers

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Teaching groups languages

You can view this information at the [end](#) of this document.

Prerequisites

It is assumed that students have a basic knowledge of Mechanics, Classic and Quantum, Thermodynamics, Statistical Mechanics and Atomic and Nuclear Physics. Several specific aspects, like energy transport, will be introduced during lectures.

Objectives and Contextualisation

The goal of this module is to provide the basic knowledge on two fundamental branches of Modern Astrophysics: structure and evolution of stars and structure and evolution of planets.

Competences

- Apply the main principles to specific areas such as particle physics, astrophysics of stars, planets and galaxies, cosmology and physics beyond the Standard Model.
- Formulate and tackle problems, both open and more defined, identifying the most relevant principles and using approaches where necessary to reach a solution, which should be presented with an explanation of the suppositions and approaches.
- Understand the bases of advanced topics selected at the frontier of high energy physics, astrophysics and cosmology and apply them consistently.

- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use critical reasoning, analytical capacity and the correct technical language and formulate logical arguments.

Learning Outcomes

1. Calculate the evolution of a star type.
2. Make a detailed analysis of the evolution of compact binary systems.
3. Recognise the different states of stellar evolution.
4. Understand the basics of stellar and planetary astrophysics.
5. Understand the interior details of the sun.
6. Understand the mechanisms of the formation of planetary systems.
7. Understand the processes of star formation.

Content

Fundamental properties of stars
 Interstellar medium and star formation
 Stellar interiors
 Stellar evolution
 Stellar atmospheres
 Magnetic activity and rotation
 Variable stars
 Evolution of compact binary systems
 The Sun and its planets
 Introduction to the extrasolar planetary systems

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory Lectures	56	2.24	2, 1, 7, 4, 5, 6, 3
Type: Autonomous			
Discussions, Work Groups, Group Exercises	62	2.48	2, 1, 7, 4, 5, 6, 3
Study of the Theoretical Foundations	64	2.56	2, 1, 7, 4, 5, 6, 3

Theory Lectures and Exercises

Classwork and Homework

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam on all the topics (2 opportunities)	50%	3	0.12	2, 1, 7, 4, 5, 6, 3
Homework	25%	20	0.8	2, 1, 7, 4, 5, 6, 3
Oral exposition on a selected topic	25%	20	0.8	2, 1, 7, 4, 5, 6, 3

One exam of all the contents, homework on all the contents, oral exposition on a selected topic.

There is a second chance to take the written exam, in case you fail the first. The oral exam will be organized by agreement between the student and the teacher.

This subject/module does not foresee the single assessment system.

Bibliography

Stellar Structure and Evolution. R. Kippenhahn, R. Weigert, A. Weiss. Springer.

Physics, formation and evolution of rotating stars. A. Maeder. Springer

Stellar interiors. Physical principles, structure and evolution. C. J. Hansen & S. D. Kawaler. Springer-Verlag

The physics of stars. A. C. Phillips. John Wiley & Sons

Black Holes, White Dwarfs and Neutron Stars. S. Shapiro and S. Teukolsky. Wiley

An introduction to Modern Astrophysics, B.W. Carrol, D.A. Ostlie ,Addison Wesley

Software

We do not use specific programs.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(TEM) Theory (master)	1	English	first semester	morning-mixed